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WILD HORSE SURVIVAL AND FOALING RATES

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INTRODUCTION

In the literature there is a major disagreement among estimates of rates of increase in wild horse herds. Increase rates calculated from Bureau of Land Management and U.S. Forest Service census data indicate annual rates of 15-20% for wild horse herds (National Research Council 1980). These estimates were questioned by Frei et al. (1979) who contended that the observed increases could be due to variability in counts caused by increasing observer experience. The National Research Council (1980) suggested that variables such as aircraft type, time of year, and changes in visibility as herds grow in size could create artificial increases in magnitude.

However, Siniff et al. (1982) found no measurable effect of observer experience in censusing horses. In addition, Eberhardt et al. (1982) presented results of aerial surveys of 2 herds in Oregon that indicated increases of about 20% per year. One area had been censused over an 11 year period by the same observer durng the same time of year utilizing the same aircraft type. Thus, it seems likely that little visibility bias occurred in this area.

High rates of increase have also been challenged from a theoretical approach. Several authors (Conley 1979, Wolfe 1980, National Research Council 1980) have concluded from demographic modelling that such high rates of increase are realized only when mortality is extremely low (0 in one model) and when foaling rates are extremely high (50% for 3 year olds, 100% for horses 4 years and older in the same model). Eberhardt et

al. (1982) used alternative models, and suggested that high rates of increase could be obtained if adult survival was extremely high and that age at first reproduction was important but less critical. In all of these studies, however, researchers have been hampered by a lack of data on survival and reproduction in free ranging herds.

Available data on survival and reproduction were reviewed by the National Research Council (1980). They found that 6 studies on feral equids had dealt with at least some aspect of demography. These studies are:

1. Tyler (1972) studied the New Forest ponies in Great Britain and reported information on foaling rates and foal and adult mortality. However, this population was subject to removal of old and debilitated animals and winter feeding by man.
2. Welsh (1975) studied wild horses on Sable Island, Nova Scotia. He provided foaling rates observed over a 3 year period for females in 3 age classes: 3, 4, 5+. He found that 11% of the 3 year olds, 33% of the 4 year olds and 69% of the horses older than 4 foaled. Foal survival varied considerably over his 3 year study period. His data suggest an annual survival rate of 86.6% (National Research Council 1980) for the adult population.
3. Feist and McCullough (1975) observed 270 horses on the Pryor Mountain Wild Horse Range, Montana for 1 year. They observed a foaling rate of 42% for females 4 years and older. Foal survival from birth to 1 November was 89%. Only 1 adult was observed to have died between 1 May and 1 November.

4. Keiper (1979) observed an unmanaged population of Shetland ponies on Assateague Island National Seashore. The annual foaling rate for mares 4 years and older varied from 43.5 to 70.5 percent between 1975 and 1979. He obtained incidental observations on survival.
5. Nelson (1979) studied a population of 116 horses in the Carson National Forest, New Mexico during 1979 and calculated a foaling rate of 55% for females 4 years and older. He observed 100% foal survival between birth and 1 September. Three adults died and 3 disappeared during his investigation.
6. Boyd (1980) studied a population of 400 horses on the Red Desert, Wyoming during 1978 and 1979. She reported that 78% of the females foaled during 1978 while only 53% foaled during 1979. Foal survival during 1978 was estimated at 82%.

This paper reports on a project designed to collect information on the following demographic parameters:

1. Age specific foaling rates
2. Foal mortality
3. Adult mortality

Color and radio collars were placed on wild horses on the Pah Rah Mustang Area and Pine Nut Mountains in Nevada during October and November 1980, March 1981 and February 1982. During periodic aerial observations on these areas in conjunction with a study of census techniques the foaling status and mortality of marked animals were noted. These data provide the basis for this report.

The authors would like to acknowledge the assistance of a number of Bureau of Land Management field personnel. The staff of the Carson City District provided invaluable assistance in capture and collaring of horses. T. Owen, T. Reuwsaat, P. Anderson, D. Pomi and B. Stewart were extremely helpful and supportive throughout the project. M. Frei, Nevada State Office also provided valuable assistance. U.S. Seal and T. Williams provided expertise in chemical immobilization.

STUDY AREAS

Pah Rah Mustang Area

The Pah Rah Mustang Area (Figure 1) is located in northwestern Nevada in BLM's Carson City District. The area contains 184,000 acres which are mostly covered by sagebrush with occasional juniper. Spanish Springs Peak, with an elevation of 8500 feet, is 3500 feet above the canyon floor. There are numerous other smaller peaks and canyons in this rugged mountainous area. The area is well deliniated by fences and roads.

Pine Nut Mountains

This area is also located in BLM's Carson City District. The bulk of this 322,000 acre mountainous area (Figure 2) is covered by pinyon-juniper. There are large open sagebrush areas at some of the lower and higher elevations. Several high peaks are present, with the highest being Mt. Siegel whose elevation is over 9500 feet. The area is isolated by a river, fences and roads.

Figure 1. Location of Pah Rah Mustang Area, Nevada.

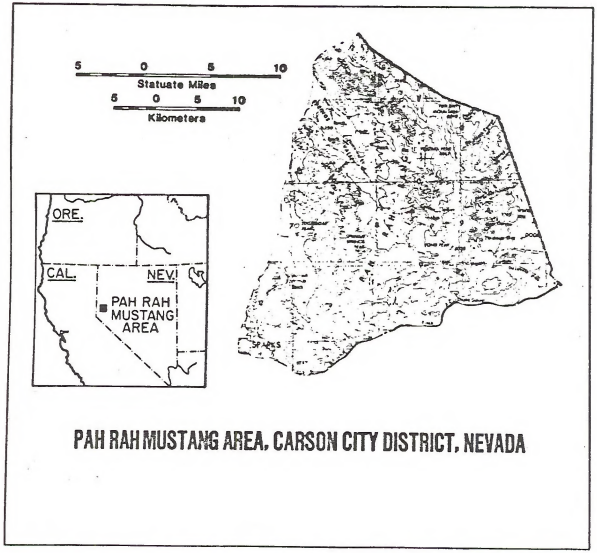
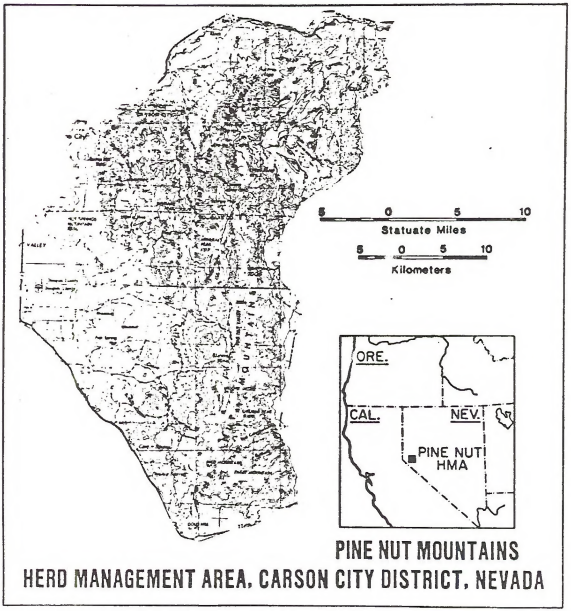


Figure 2. Location of Pine Nut Mountains, Herd Management Area, Nevada.



METHODS

Collaring

Numbered collars with and without radio transmitters were placed on horses on the Pah Rah and Pine Nut HMA areas during October and November 1980, March 1981 and February 1982. A summary of the number of females collared is presented in Table 1.

All collars were constructed of 4" wide 3 ply food conveyor belting. The white-colored belting was tapered to 1 1/2" wide in the area that fits under the neck to minimize wear and irritation to the horse that might develop from neck movement. All collars were numbered with 2" x 3" orange or yellow cattle tags. Radio transmitters placed on horses during 1980 and 1981 had an estimated battery life of 2 years while the 1982 transmitters had an expected life span of 4 years.

Horses that were collared in 1980-81 were captured using conventional gatherings with helicopters and the Nevada BLM Capture Crew. Horses collared in 1982 were immobilized with a Rompum-M99 combination (Seal et al. 1982).

Field Observations

Most of the foaling and mortality observations were made in conjunction with census flights on the study areas. The typical procedure involved a helicopter flight of the area during which all collared horses that were encountered during the flight were noted and their foaling status was observed. We found it more cost effective to conduct followup flights using a Piper Super Cub to locate radio collared

Table 1. Summary of number of females collared on Pine Nut Mountains and Rah Rah Mustang Area. Radio transmitters placed on horses during 1980-1981 had an estimated battery life of 2 years while 1982 transmitters had a 4 year estimated lifespan.

Area	1980-81		1982		Total
	Radio Collars	Marker Collars	Radio Collars	Marker Collars	
Pah Rah Mustang Area	25	23	41	-	89
Pine Nut Mountains	31	20	29	-	80
Totals	56	43	70	-	169

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horses missed during the helicopter flight. This was meant to maximize our sample size and detect any mortality or tag loss that might have occurred. On a few occassions, only the Supercub was used to make observations. Dates of flights conducted during 1981-82 are given in Table 2.

Ground observations were made during both 1981 and 1982 to confirm aerial observations and to increase the sample size of observed horses. These observations were made from horseback, vehicles, and on foot.

It should be emphasized that estimates of foaling rates and foal mortality obtained in this manner represent minimal estimates. Given the frequency of observations, it is possible that a female could have foaled and the foal died in the time period between observations. If this occurred, the female would have been recorded as having never foaled and the foal mortality would have been missed.

RESULTS

Table 3 presents summary data for foaling and foal mortality observed during 1981 and 1982. Foaling rates were comparable for both years on the Pah Rah Mustang area. On the Pine Nut Mountains, foaling was significantly lower for 1982 as compared to 1981. This difference was also apparent in the data on foaling frequency for the 2 years. On the Pah Rah area 45% of the females observed foaled both years while only 10% of the females foaled both years on the Pine Nut Mountains. Foal mortality rates range from 2 to 33% over the 2 years on both areas.

Table 2. Dates of flights during which foaling and mortality observations were made on the Pah Rah and Pine Nut Mountain areas.

	Pah Rah Mustang Area	Pine Nut Mountains
1981	5 May	7-8 May
	3 July	2-3 July
	7 September	21 July
1982	6-7 May	April
	2 July	20-22 May
	27 July	2-3 July
	19 September	28 July
		18 September

Table 3. Foaling summary for Pine Nut Mountains and Pah Rah Mustang Area 1981-1982.

	Pine Nuts		Pah Rahs	
	1981	1982	1981	1982
Females	38	66	39	70
Foals	20	20	25	48
Foaling Rate	.53	.30	.64	.69
Foal Mortalities	3	2	8	1
Foal Mortality Rate	.15	.10	.33	.02
Females Foaling Both Years	3 (10%)		13 (45%)	
Females Foaling 1 of 2 Years	18 (62%)		10 (34%)	
Females Not Foaling Either Year	8 (28%)		6 (21%)	

Age-specific foaling data combined for 1981 and 1982 are presented in Table 4 and graphically in Figure 3. One would expect an increasing foaling rate as horses matured from 2 year olds, peaking in the middle age class and then declining with the older age classes. The number of data points presented here is limited, but Figure 3 suggests that there may be only a limited decline in foaling rates with age.

Adult female mortality was extremely limited during the study period. Information on the mortalities that were observed is presented in Table 5. In most cases, scavengers and decomposition made it impossible to determine the cause of mortality.

Adult female mortality rates can be estimated from the number of radio collared females observed. For the Pah Rah Mustang Area, during 1981 1 mortality was observed for 25 radio collared females (4%) while only 1 mortality was observed for 56 radio-collared females (2%) during 1982. On the Pine Nut Mountains, during 1981 1 mortality was observed for 22 radio collared females (4%) and during 1982 only 1 mortality was observed for 50 females (2%). Observations are for the entire year of 1981 but only the first 9 months of 1982.

DISCUSSION

In order to fully understand the differences in foaling rates between the Pah Rah Mustang Area and Pine Nut Mountains, it is important to have an understanding of the forage conditions on these areas. Bureau of Land Management data (Dept. of Interior 1982) indicate that the ecological range condition of 83% of the study area in the Pine Nut Mountains is

Table 4. Age specific foaling for 1981-1982 on Pah Rah Mustang Area and Pine Nut Mountains, Nevada.

	Pah Rahs		Pine Nuts	
Age Class	Number Observed	Foals	Number Observed	Foals
2	2	1	1	0
3	11	6	7	2
4	14	8	13	5
5	14	11	13	4
6	7	3	8	5
7	3	2	8	0
8	7	5	7	5
9	15	13	11	5
10	13	11	12	5
11	8	3	8	3
12+	14	9	14	6
Unknown	1	1	-	-

Figure 3. Percentage of females foaling in each age class for females on the Pah Rah Mustang Area and Pine Nut Mountains, Nevada. Observations are combined for 1981 and 1982.

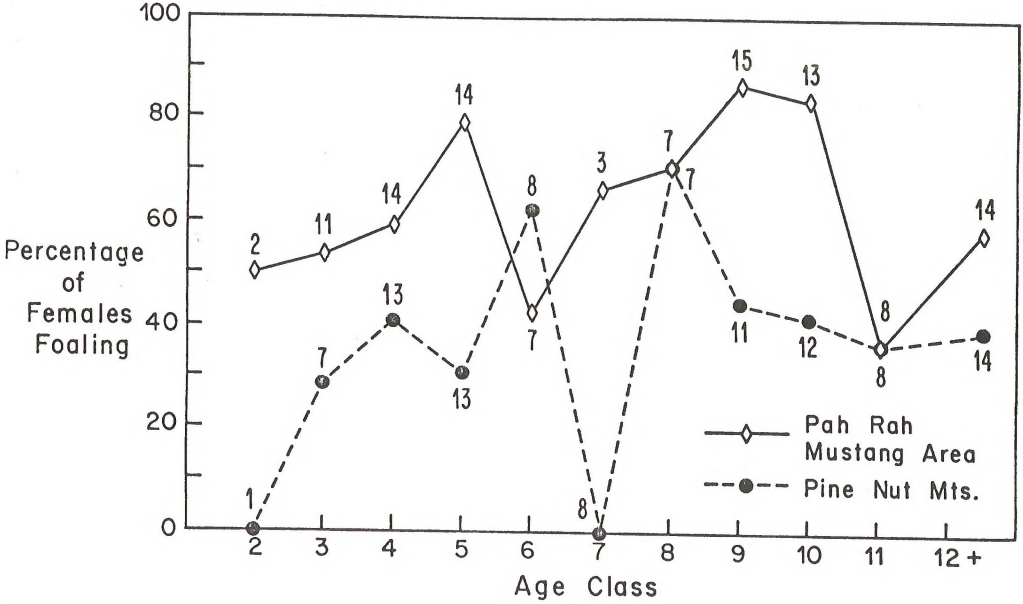


Table 5. Mortalities of four adult female wild horses observed on the Pah Rah Mustang Area and Pine Nut Mountains, Nevada during 1981-82.

Pine Nut Mountains		Pah Rah Mustang Area	
Date	Age	Date	Age
November 81	12+	July 81	8
April 82	12+	Sept 82	9

classified as poor, 13% fair and 4% as good. On the Pah Rah Mustang Area, only 37% of the area is listed in the poor classification while 44% is listed as fair and 19% is listed as good.

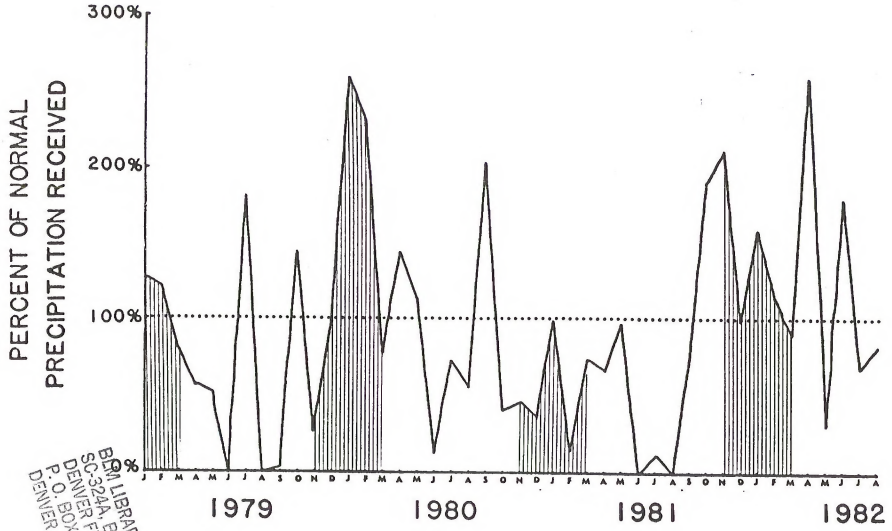
It seems probable, based on numerous investigations of big game species (Verme 1965, 1969), that differences in range condition between the two areas are a major contributing factor to the differences in foaling rates observed. Hence, it appears likely that forage condition will influence whether or not a wild horse poulation is decreasing, stable, or increasing. Annual forage production is determined, to a large extent, by moisture conditions.

In western Nevada most precipitation falls from November to March. Precipitation was generally above average in 1979-80, below average in 1980-81 and above average in 1981-82 (Figure 4). It seems logical to assume that better forage growth occurred in 1980 and 1982 than in 1981, following the winter of below-average precipitation.

Horses in the Pine Nuts were observed to be in fair to good condition during fall 1980, but no foaling data could be obtained for the 1980 season. The physical condition of these horses appeared to deteriorate during the summer and fall of 1981 and showed improvement in summer of 1982. Foaling rates for marked horses were .53 in 1981 and .30 in 1982. The higher value in 1981 might be related to the better condition of the horses observed in fall 1980 and the lower foaling rate in 1982 might be related to the decline in physical condition observed in summer and fall of 1981.

Condition of the mare undoubtedly influences the condition of the

Figure 4. Monthly precipitation at Carson City, Nevada (NOAA 1979-82). Shown is the percent of normal precipitation received. Darkened areas represent precipitation received during November through March. Precipitation during these months represents 74% of the normal annual precipitation.


PERCENT OF NORMAL
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foal. Although data are sparse, the foal mortality rate was higher in 1981 than 1982, confirming the pattern described above (Table 3).

These trends were not observed for horses in the Pah Rah Mustang Area, however. The foaling rate remained high both years. Foal mortality was higher during 1981 than 1982. It may be that because the forage is in better overall condition here, the horse population is somewhat insulated from changes in vegetation that may result from changes in precipitation.

Exactly how a wild horse population will react demographically overall to changing forage conditions is still difficult to predict. Adult female mortality remained extremely low both years of this study. Foal mortality varied considerably from year to year and area to area. Given the limited nature of this study, the information collected is not sufficient for population modelling.

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